Serial Number: 09/681,186
Filed: February 14, 2001
Group Art Unit: 2882

~~t~~This object is achieved by the features of claim 1 ~~(method claim)~~ and by the features of claim 11 ~~(apparatus claim)~~. Advantageous developments of the method and the apparatus are evident from the corresponding dependent claims.~~L~~

In the claims:

1.(Currently amended) A method for examining structures on a semiconductor substrate ~~(7)~~ that has a thickness, the method comprising:

penetrating and imaging ~~of~~ the structures with X-radiation ~~(1)~~ in an imaging X-ray microscope onto a spatially resolving detector ~~(9,12)~~; and

establishing of a wavelength or a wavelength region of the X-radiation as a function of the thickness of the semiconductor substrate ~~(7)~~ in such a way that ~~the~~ transmission of the X-radiation through the semiconductor substrate ~~(7)~~ is at least sufficient for detection of the X-radiation and for obtaining a high-~~contract~~ contrast image.

2.(Currently amended) The method as defined in Claim 1, further comprising reducing the thickness of the semiconductor substrate ~~(7)~~ without affecting the structures.

3.(Currently amended) The method as defined in Claim 1, wherein the semiconductor substrate ~~(7)~~ is made of silicon, the substrate thickness is less than 30 μ m, and the X-radiation has a wavelength between 0.1 nm and 2 nm.

4. (Currently amended) The method as defined in Claim 1, wherein the wavelength of the X-radiation is selected in accordance with ~~the~~ Rayleigh-Gans algorithms for scattering to provide an optimum X-ray optical scattering capability for the structures on the substrate ~~(7)~~ in order to obtain ~~a~~ the high-contrast image with a high signal-to-noise ratio.

5. (Currently amended) The method as defined in Claim 1, wherein the wavelength of the X-radiation selected for ~~the~~ examination of metal structures on the substrate ~~(7)~~ is in ~~the~~ a vicinity of ~~the~~ corresponding absorption discontinuities of the metals, resulting in ~~a~~ the high image contrast.

Serial Number: 09/681,186
Filed: February 14, 2001
Group Art Unit: 2882

6. (Currently amended) The method as defined in Claim 1, wherein the X-radiation impinges upon the semiconductor substrate ~~(7)~~ at a side containing no structures.

7. (Currently amended) The method as defined in Claim 1, wherein the structures are imaged at different observation angles in order to allow stereographic and tomographic reconstructions.

8. (Currently amended) The method as defined in Claim 1, wherein the X-ray microscope is operating in phase contrast to provide a minimum number of photons and minimal exposure time for obtaining an image.

3 Cont

9. (Currently amended) The method as defined in Claim 1, wherein a segmented phase plate ~~(2a, b, c)~~ is used in ~~the~~ a back focal plane of ~~the~~ an X-ray objective.

10. (Currently amended) The method as defined in Claim 9, wherein a segmented stop ~~(29)~~ disposed between an X-ray source and a condenser ~~(3)~~ of the X-ray microscope is used.

11. (Currently amended) The method of Claim 10, wherein a segmented annular condenser zone plate ~~(19)~~, or a rotating condenser ~~(13)~~ having a chopper disk, is used as the condenser ~~(3)~~.

12. (Currently amended) An imaging X-ray microscope for examining structures on a semiconductor substrate ~~(7)~~ having a thickness, the X-radiation microscope comprising:

an objective ~~(8)~~ for imaging the structures with X-radiation on a spatially resolving detector ~~(9, 12)~~; and

an X-radiation source ~~(1a)~~ generating the X-radiation having a wavelength which is a function of the thickness of the semiconductor substrate ~~(7)~~, wherein transmission of the X-radiation through the semiconductor substrate ~~(7)~~ is at least sufficient for detection of the X-radiation, and for obtaining a high-contrast image.

13. (Currently amended) The imaging X-ray microscope as defined in Claim 12, wherein a segmented phase plate ~~(20)~~ is disposed in a back focal plane of the X-ray objective ~~(8)~~.

Amend

14. (Currently amended) The imaging X-ray microscope as defined in Claim 13, wherein a segmented stop ~~(29)~~ is disposed between the X-radiation source and a condenser ~~(3)~~ of the X-ray microscope.

15. (Currently amended) The imaging X-ray microscope as defined in Claim 14, wherein a segmented annular condenser zone plate ~~(19)~~ or a rotating condenser ~~(13)~~ having a chopper disk is provided as the condenser ~~(3)~~.